Missouri Targets
Biosciences



MISSOURI
Department of Economic Development
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TIMELY TARGETED INTELLIGENT

October 2011

Missouri Targets

Biosciences

Introduction

The Missouri Department of Economic Development adopted the 2011 Strategic Initiative for Economic Growth to identify innovative industries with high growth potential as a frame for targeted economic and workforce efforts. Seven broad industry clusters were identified as having a higher than normal potential for employment and economic growth: Advanced Manufacturing, Biosciences, Energy Solutions, Health Sciences and Services, Information Technology, Financial and Professional Services, and Transportation and Logistics.

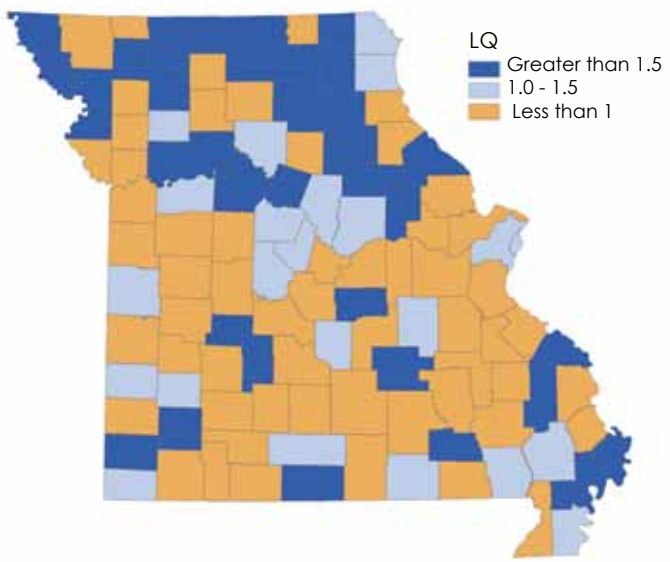
The Missouri Biosciences sector primarily targets a cluster of industries focused on plant, animal, and human biological research and product development. Organizations conducting scientific research and development, diagnostic laboratories, producers of pharmaceutical and chemical components, animal health and food products, and medical equipment, are examples of industries included in this cluster.

The Bioscience industry is built on the strength of companies, research institutions, service providers, and trained workers that together create a competitive advantage for Missouri. Like most clusters, it is formed from historic strengths that, if nourished through education, investments and innovations, will continue to provide economic prosperity well into the future.

Currently the Bioscience private sector employees over 50,000 workers in Missouri which, based on 2010 figures, puts the industry job count at pre-recession levels. The cluster pays well with an average annual wage of nearly $59,000, well above the $40,681 state average.

Bioscience employment levels are highest along the Interstate 70 corridor with large densities found in St. Louis, Kansas City, and Columbia. The Springfield, St. Joseph, Joplin, and Cape Girardeau metros also have large numbers of employees in this cluster.

County Dependence on Bioscience Employment



But the influence of Bioscience companies reaches past the metros of Missouri when employment concentrations are considered. The county map, using location quotient analysis (see Methodology), illustrates areas of the state where Bioscience jobs account for a larger share of employment than the national averages.

The broad impact of Bioscience companies across Missouri is not surprising given the state's rich history of farming, food product development, and scientific research that all provide input to, and benefit from, each other's efforts.

Although most farm employment is not available for 2010 or captured in this sector, figures from 2007 show that over 163,000 farmers, and 47,000 hired workers, operated in the state. Missouri is ranked second in the nation for the number of farms, at 108,000, and is known as a large livestock, soybean, and corn producer. Located in the farm belt of America, Missouri's agricultural strength has set the groundwork for Bioscience companies to grow and flourish.

As the world gets smaller, in the sense of connected economies and people, the opportunities for Missouri to share its Bioscience strengths will continue to increase. Despite the current economic worries that developed countries face, the long-term prospects for global growth are bright and include a rising middle class in parts of Asia, Latin America, and other emerging markets that will demand better food products and healthcare. Key to meeting that demand will be the scientific discoveries developed here in Missouri. Bioscience exports will increasingly gain in importance as will the food, pharmaceutical, and other related products that farmers and factories currently send abroad.

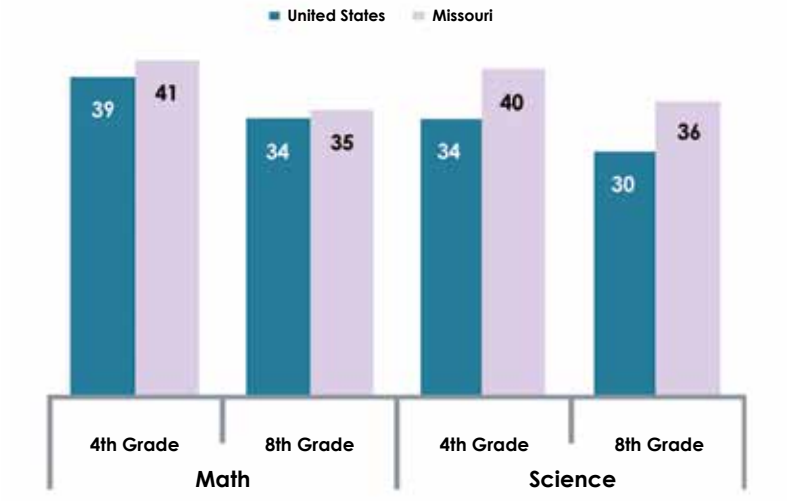
The remainder of this report looks at some education progress and programs that are planting the seeds of future growth, investments and innovations that help nurture this industry, and the niche strengths Missouri currently has in Plant and Animal, and Biomedical Sciences.

Planting the Seeds - Education

Many occupations in the Biosciences sector require strong skills in math, technology, engineering, and science. In order to meet the labor demands of this industry and attract new firms to the region, the state places great emphasis on increasing the proficiency of math and science skills at the elementary, secondary, and higher education levels.

According to the National Assessment of Educational Progress (NAEP), Missouri is exceeding the national averages for math and science proficiency for grades 4 and 8. Admittedly, further improvements in elementary school proficiency will help bolster the number of high school and higher education students interested in math and science related degrees, helping Missouri compete globally in the Biosciences labor market.

PercentAt or Above Proficient in Math and Science
National Assessment of Educational Progress (NAEP), 2009



Between 2005 and 2009, nearly a quarter of Biosciences-related degrees and certificates awarded by Missouri two- and four-year public and private colleges were for Engineering or Biological and Biomedical Sciences. These institutions graduated 5,254 Biosciences-credentialed students in 2009. Higher education opportunities for Biomedical studies include Associate through Doctoral and First Professional (MD) degrees. For example:

- St. Louis Community College, in 2009, was a founding member of the Bio-Research and Development Growth (BRDG) Park at the Danforth Plant Science Center. By embedding workforce development in a Biomedical business incubator, the College helps students gain real-world scientific experience, while also helping budding companies find and train the perfect talent to help them grow.

Starting Early –Biosciences

Missouri academic institutions, at all levels, actively develop a Biosciences workforce for the future. Recognizing the importance of Science, Technology, Engineering and Math (STEM) curriculum to college preparatory studies and employer demands, 44 Missouri middle schools supplement their curricula with a Pre-Engineering program, developed by *Project Lead The Way (PLTW)*, designed to translate engineering fundamentals into everyday applicability.

Many Missouri high schools offer the supplemental Biomedical Sciences program developed by *PLTW*. In addition to core competency instruction, students are encouraged to investigate realistic Biomedical mysteries and design innovative solutions. The PLTW curriculum engages area Biosciences professionals as mentors to help communicate the real-world applicability of a student's work, and share opportunities to continue the work in college and eventually professionally.

- Public and private college research institutions offer Bachelor and Master of Science degrees in Biomedical Engineering, Tissue Engineering and Biomaterials, Virology, Bioinformatics and Biostatistics.

- Missouri institutions award Doctoral degrees for research in Biochemistry, Pharmacological and Physiological Sciences and more than ten different genetics specialties.

- Missouri hosts 11 teaching hospitals in Columbia, Kansas City and St. Louis. Hospital specialties include Diabetes, Endocrinology, Kidney Disorders, Neurology/Neurosurgery and Pulmonology.

Training a skilled workforce for the Bioscience sector, along with other high-skilled industries, is still a challenge that states must continue to address. For example, a 2009 Manufacturing Institute survey of "Life Sciences and Medical Devices" producers found that 66% of companies had a moderate-to-serious shortage in skilled production workers while 38% reported the same problem in finding scientists and engineers. These shortages existed even while a deep recession put many people out of work. Long-term Bioscience competitiveness as a state and nation will increasingly depend on better workforce skills and education, particularly in the fields of science, technology, engineering, and mathematics.

Nurturing Growth - Investment

Missouri hosts a variety of research centers and incubators designed to support entrepreneurs as they test ideas and run market assessments. Half of the 20 Biosciences research centers in the state are affiliated with the University of Missouri system. Of the 11 specialized incubators/research parks, five are in the St. Louis region while others are spread throughout the state. In addition to providing collaborative space for innovators, the administrators of these facilities help connect ideas to crucial proof of concept, seed and start-up funding sources, like the Missouri Technology Corporation.

Bridging the financial gap between innovation and commercialization is crucial to the continued growth of Biosciences in Missouri. One program, the Technology Acceleration Program (TAP), managed by Missouri University of Science & Technology, appropriates a portion of patent royalties as seed money for new projects. This type of Proof of Concept funding is hard to come-by, but crucial to the commercialization process.

Venture Capital (VC) investment in innovation is highly sought after but usually comes later in the capital lifecycle during the introduction and early growth phase of a start-up. Between 1995 and 2010, $2.5 billion of VC was invested in Missouri with three percent of the money directed to a total of 29 Biotechnology deals. Biotechnology is defined, by PricewaterhouseCoopers and National Venture Capital Association, as "developers of technology promoting drug development, disease treatment and a deeper understanding of living organisms. It includes human, animal and industrial biotechnology products and services, biosensors, biotechnology equipment and pharmaceuticals.

Missouri Technology Corporation
A public-private partnership created by the Missouri General Assembly to promote entrepreneurship and foster the growth of new and emerging high-tech companies with a focus on 21st Century bioscience industries that build on Missouri's rich history in agriculture. The MTC administers the following investment programs available to companies that locate or expand in Missouri:

- **Bioscience Industrial Expansion Program —** MTC supports industrial expansion efforts in Missouri that result in significant capital investment and high-paying jobs in targeted high-tech bioscience clusters typically through secured low-interest loans that can be used to purchase equipment, facilitate construction, and hire key personnel.
- **Seed Capital Co-Investment Program –** MTC will award seed capital funds that match qualified private capital investments to position Missouri high-tech start-up companies for venture capital financing.
- **TechLaunch –** The Missouri TechLaunch program will provide pre-seed financing to help high-tech entrepreneurs overcome the principal challenges of launching new start-ups that leverage discoveries and talent at Missouri's world-class public and private research universities and other research organizations.

Investments in building collaborative partnerships across the state and telling Missouri's Bioscience story also nurture growth in this promising sector. Large efforts currently underway include the ***Kansas City Animal Health Corridor***, the ***BioSTL*** initiative, and the Missouri Biotechnology Association, or ***MOBIO***. All of these efforts work to pull together businesses, researchers, and other institutions around common areas of strength. Just as important, these initiatives combine resources to tell the world their unique story.

The ***Kansas City Animal Health Corridor***, which promotes the animal health and nutrition industry, stretches from the University of Missouri in Columbia westward through Kansas City to Kansas State University in Manhattan, KS. It also reaches north to St. Joseph. Companies in the corridor account for nearly 32% of global sales in the animal health market, according to Corridor figures. That is a concentration found nowhere else in the world and one this initiative promotes well.

The ***BioSTL*** effort, recently formed as an outgrowth of earlier bioscience initiatives, brings together a coalition of companies, research institutes, and local leaders to promote efforts to advance innovation and entrepreneurship that builds on St. Louis' world-class medical and plant bioscience assets. Local organizations have committed $30 million in funding to assist with pre-seed and seed investments aimed at growing new bioscience companies and jobs in the St. Louis region.

The Missouri Biotechnology Association, ***MOBIO***, is a statewide nonprofit trade association of companies, colleges, research institutions, and service firms committed to the growth of the biotechnology and biomedical economy in Missouri. Efforts of MOBIO include support for research commercialization, increasing bioscience education in the school environment, and advancing biotechnology public policy goals.

Investments in education, research, funding, and marketing will nurture growth in this industry and result in innovations that continue to put Missouri on the Bioscience map.

Nurturing Growth - Innovation

Missouri's Biosciences employers, colleges, business incubators, research hospitals, foundations and professional coalitions support entrepreneurs as they transform innovative research into commercially-viable products. These investments capitalize on the proven potential for spin-off employment through technology transfers and research commercialization but the process is costly. After research may come clinical trials, of which, as of October 2011, Missouri hosts 6,454, or 11 percent of the federally and privately supported United States trials registered with the U.S. National Institutes of Health.

Often intellectual property or innovations must be protected through patenting. According to the U.S. Patent and Trademark Office (PTO), between 2006 and 2010 Missouri Assignees were awarded 3,721 Utility patents in 182 classifications. Classifications with the top five-year totals for Missouri Assignees were all Biosciences-related classes.

Patent Classes	2006	2007	2008	2009	2010
Multicellular Living Organisms	20	27	28	21	45
Drug, Bio-Affecting and Body Treating Compositions	59	30	31	21	34
Chemistry: Molecular Biology and Microbiology	18	26	20	20	34
Organic Compounds	20	25	22	27	30
Surgery	20	13	10	13	20

Top Missouri Patent Assignees

In 2010, 975 patents were granted to over 100 Missouri companies or individuals. Top research universities and Biosciences companies were among the top 25 Missouri Utility patent assignees. The five Bioscience companies listed below were awarded 371 Utility patents between 2006 and 2010.

Research Universities
1. Washington University
2. University of Missouri System
3. St. Louis University

Bioscience Companies
1. Monsanto Technology, Inc.
2. Mallinckrodt, Inc.
3. Stereotaxis, Inc.
4. Covidien AG
5. Phamacia Corporation

To further categorize the Utility patents, the PTO profiles patenting in 30 product fields, based on the 2002 North American Industry Classification System. Missouri's 2008 Assignees were granted 90 Biomedical-related patents for Basic Chemicals, Other Chemical Products and Preparation, Pharmaceutical and Medicines, and Medical Equipment and Supplies.

Missouri's Biomedical-related patents represent 15 percent of all patents issued to Missouri Assignees. This compares to 13 percent for the Midwest (MO plus surrounding states). Two strong Biomedical states California and Massachusetts, by comparison had 12 and 20 percent, respectively, of patents in Biomedical related fields.

East and West coast biotech hubs, like Boston and San Francisco, are projected to remain dominate Biosciences employment centers; but regional markets that recognize and develop a competitive advantage through niche areas can reap the benefits of growth. Missouri's proven competitive advantages in Plant, Animal, and Biomedical sciences offer great potential for long-term economic growth.

Biosciences
Plant and Animal Sciences

With over 29 million acres in farmland, roughly 66% of the state, Missouri's agriculture industry provides a strong mutually beneficial base from which the Plant and Animal Science research and services sector can thrive alongside its agricultural counterpart. This sector targets biochemical research and product development as it relates to plant and animal production and animal health. Chemical manufacturing, animal food manufacturing, farming, and crop production are some of the many facets of Plant and Animal Sciences.

Employers

Missouri's top employers in the Plant and Animal Sciences industry include agricultural innovators in biology and chemistry such as Monsanto, Sigma-Aldrich, Boehringer Ingelheim Vetmedica, Inc., Bayer CropScience, Mississippi Lime Company, BASF Agricultural Products, Millipore, and the Donald Danforth Plant Science facility. Food manufacturers such as Nestle Purina, Gilster-Mary Lee, Farmland Foods, Mars Petcare, and Land O'Lakes Creameries are also large employers in this cluster.

The U.S. Soybean Export Council, National Biodiesel Board, National Corn Growers Association, American Soybean Association, American Angus Association, and the Dairy Farmers of America represent prominent agriculture associations headquartered in Missouri that have a vested interest in improving the yield of their products through research developed by this targeted industry sector.

Employment

Missouri non-farm employment increased in this sector by 4% over the last five years, outpacing the U.S. trend of 1.8%. Within this sector research and development (excluding biotechnology), basic chemicals, and veterinary services are all above the U.S. trend; with animal food manufacturing showing a modest gain. Pharmaceuticals and medicines manufacturing has experienced a five year decline in employment, however, export data from 2010-2011 is showing a much more favorable increase for pharmaceuticals and medicines which should equate to job increases this year.

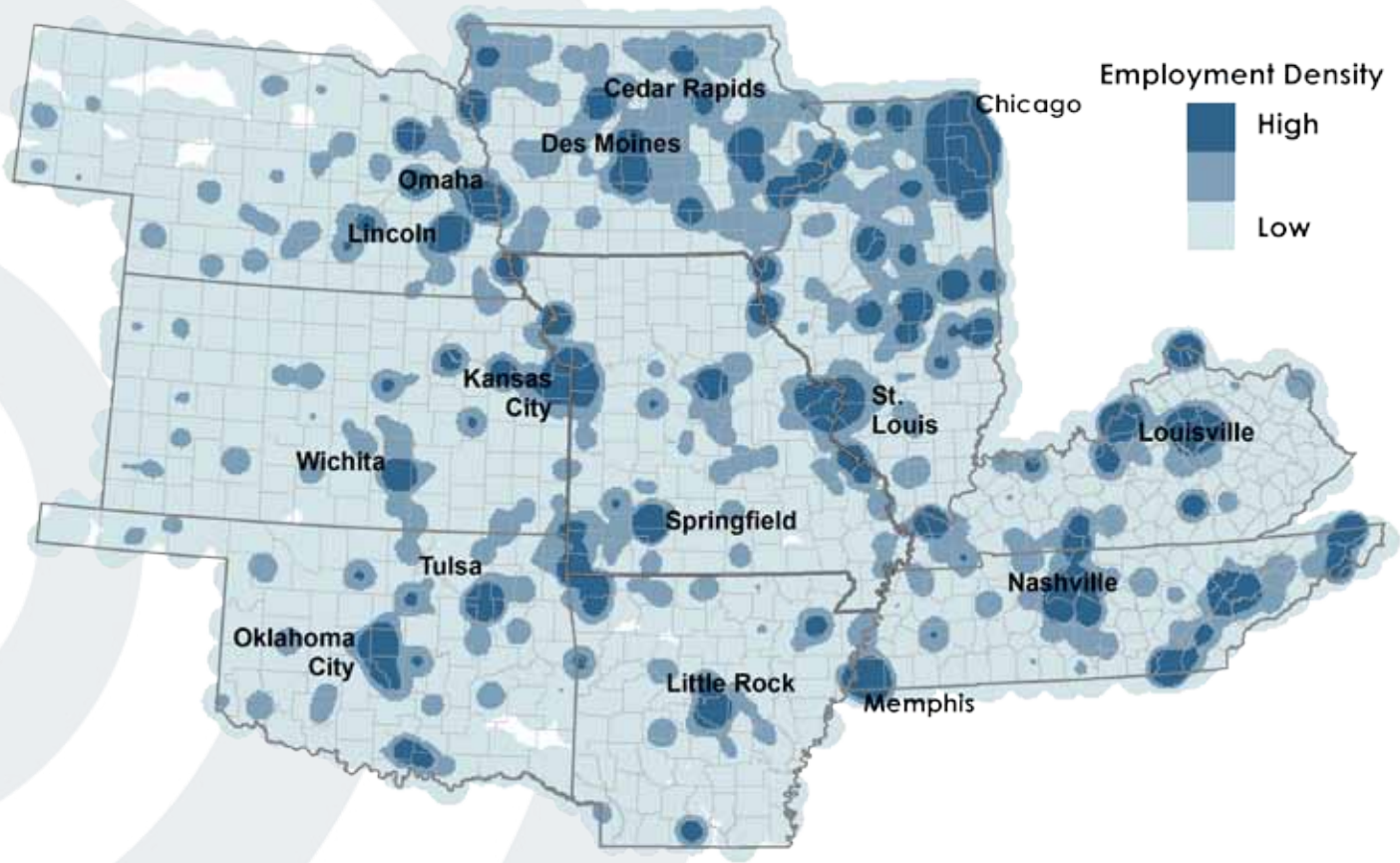
Plant and Animal Science Employment Trends 2006-2010

Midwest Employment Trends

Missouri ranks second behind Illinois in Animal and Plant Sciences sector employment within the Midwest with 15% of the cluster's total non-farm employment in the nine-state area. Employment density is highest in the metro areas of St. Louis, Kansas City, St. Joseph, Columbia, Springfield, and Joplin. The regional map highlights the areas of heavy employment density for the Animal and Plant Sciences cluster.

The Missouri public and private sector employment trend from 2006-2010 showed a modest increase, with employment gains of 4%. Illinois, with over a third of the region's employment in this sector, showed a job loss of -6.4%. Kansas had the highest percentage gain from 2006-2010, with 19.4%. Illinois was the only state to experience job loss in this sector. The Midwest over-the-year employment trend held steady with an estimated +1.8% increase.

Regional Employment Density for Plant and Animal Sciences



Missouri Plant and Animal Science Exports

Missouri's export mix has a higher concentration of Plant and Animal Science exports than the national average, ranking 14th among all states. This sector's export value makes up over 24% of the total Missouri commodity base and has shown a healthy growth of 36% between 2006 and 2010. National growth in this sector was 49% over the last five years.

The state's biggest exporting industries in this sector include basic chemicals, pharmaceuticals and medicines, grain and oilseed milling products, and agricultural chemicals. Compared to national averages, the state also has high export concentrations in the areas of swine exports, animal foods, grain and oilseed milling products, and agricultural chemicals, as seen in the 2010 location quotient (LQ) numbers. For example, Missouri exports nearly 2.4 times more basic chemicals than the national average.

While Missouri may have trailed the nation in the five year trend, several commodity sectors are above the national trend in over-the-year growth including pharmaceuticals and medicines, swine exports, grain and oilseed milling products, and animal foods. The table below highlights the five year trends and the over-the-year trends in Plant and Animal Science commodities.

Industry	2010 MO EXPORTS	%2006-2010 MO	%2006-2010 US	Plant and Animal Science MO Export 2010 LQ	MO Plant and Animal Science 2010-2011 YTD Trend (% Diff from US)
TOTAL ALL INDUSTRIES	$12,925,559,774	1.1	24.6		
TOTAL PLANT AND ANIMAL SCIENCE INDUSTRIES	$3,153,318,792	36.2	48.9	1.84	-9.2
High Growth (5 yr trend) / High Concentration					
Basic Chemicals	$1,394,253,745	72.4	26.9	2.36	-20.5
Low Growth (5 yr trend) / High Concentration					
Pharmaceuticals And Medicines	$765,126,673	12.8	48.8	1.53	16.6
Grain And Oilseed Milling Products	$356,861,621	18.4	78.5	2.76	10.3
Pesticides, Fertilizers And Other Agricultural Chemicals	$200,094,366	2.7	49.1	2.45	-2.0
Animal Foods	$93,706,512	25.3	35.3	3.90	2.2
Swine	$920,479	-52.6	-65.7	10.54	270.8
Low Growth (5 yr trend) / Low Concentration					
Oilseeds And Grains	$153,736,160	34.7	90.0	0.88	-37.1

Workforce

Missouri's Plant and Animal Science occupations are primarily made up of Production Line positions (18%), Office Administration and Support Services (17%), Science and Research Services (9%) and Veterinary Healthcare Practitioners and Technicians (7%). The Plant and Animal Science sector is projected to increase employment by 11.5% over the next 10 years, compared to 3.6% for all occupations.

Of the Plant and Animal Science occupational groups projecting growth over the next decade, Veterinary Healthcare Practitioners and Technicians are expected to make up nearly 16% of the growth with Science and Research Services and IT Services constituting 14% and 12% of the growth respectively. Wages for the growth occupations are estimated to average nearly $51,000. Specifically, the Plant and Animal Science occupations of Veterinarians, Veterinary Assistants and Laboratory Animal Caretakers, and Veterinary Technologists are expected to experience the most growth and hold the largest number of jobs in this sector over the next decade.

Top Occupations by Projected Growth 2008-2018

Plant and Animal Science Occupations	Typical Education	Average Wage
Veterinarian Staff and Animal Caretakers		
Veterinarians	First professional degree	$71,112
Veterinary Assistants and Laboratory Animal Caretakers	Short-term on-the-job training	$20,020
Veterinary Technologists and Technicians	Associate degree	$27,345
Nonfarm Animal Caretakers	Short-term on-the-job training	$21,037
Management and Administrative Services		
Receptionists and Information Clerks	Short-term on-the-job training	$23,480
Office Clerks, General	Short-term on-the-job training	$27,724
Business Operations Specialists, All Other	Bachelor's degree	$60,872
Executive Secretaries and Administrative Assistants	Work Experience in a Related Occupation	$41,896
Scientists and Research		
Market Research Analysts	Bachelor's degree	$61,898
Biochemists and Biophysicists	Doctoral degree	$63,276
Biological Technicians	Bachelor's degree	$36,503
IT Services		
Computer Specialists, All Other	Associate degree	$74,506
Network Systems and Data Communications Analysts	Bachelor's degree	$74,788
Production		
Mixing and Blending Machine workers	Moderate-term on-the-job training	$35,133
Industrial Machinery Mechanics	Long-term on-the-job training	$43,547

Analysis of education and experience levels typically required by all occupations in the Plant and Animal Science sector shows that 26.1% are considered lower skilled, 43.7% are middle skilled, and 30.2% are high skilled. Plant and Animal Science skill requirements are more heavily weighted towards middle to high skill occupations with 73.9% of the jobs in this sector requiring middle to high skills compared to 63.6% for all occupations in Missouri.

Biosciences
Biomedical Sciences

Biomedical sciences focuses on the study of the structure and function of the body and the mechanisms of disease and health at the molecular, cellular, organ, and system levels. This sector is heavily involved in improving the processes for diagnosis, prevention, and treatment of diseases. Biomedical specialties include research and development, pharmaceutical discovery and manufacturing, genomics, medical devices, and diagnostics and imaging.

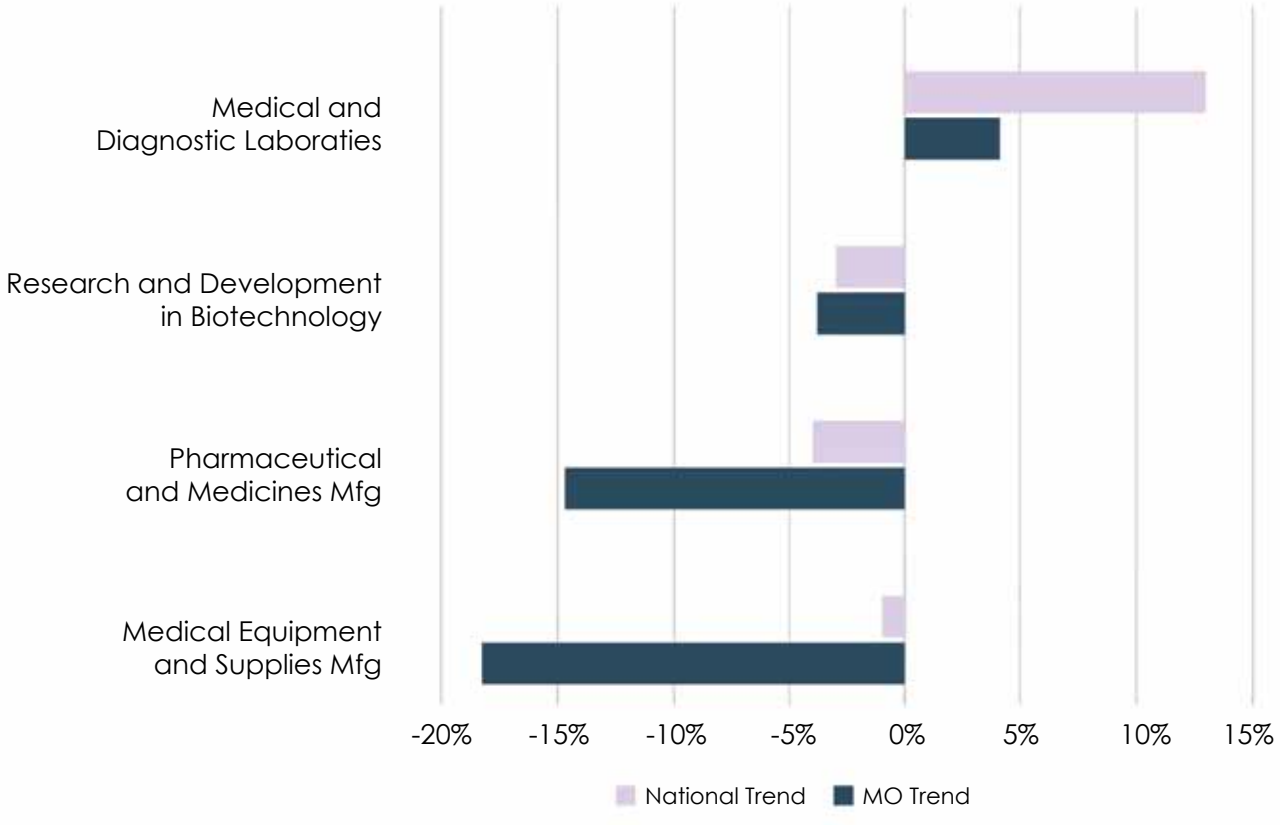
Employers

Missouri's top employers in this sector include research, diagnostic, and pharmaceutical firms such as Quest Diagnostics, Pfizer, bioMérieux, Sanofi-Aventis U.S., Pharmacia & Upjohn, Midwest Research Institute. Other prominent research firms include Sinclair Research Center, Stowers Institute, St. Luke's Regional Labs, Inovatia Laboratory, and ABC labs. Top employers involved in medical equipment manufacturing include Tyco Healthcare Group, Meridian Medical Tech, Bausch & Lomb, Bio-Medical Applications, and Cardinal Scale.

Employment

Missouri non-farm employment in this sector declined by -9% over the last five years, in contrast to the modest U.S. gains of 1%. Similar to the national trend, medical and diagnostic laboratories was the only subsector to experience employment growth in Missouri. Pharmaceuticals, medicines, and medical equipment manufacturing experienced a five year employment decline, however, export data from 2010-2011 is showing a much more favorable increase in these commodities which should equate to job increases this year.

Biomedical Sciences Employment Trends 2006-2010

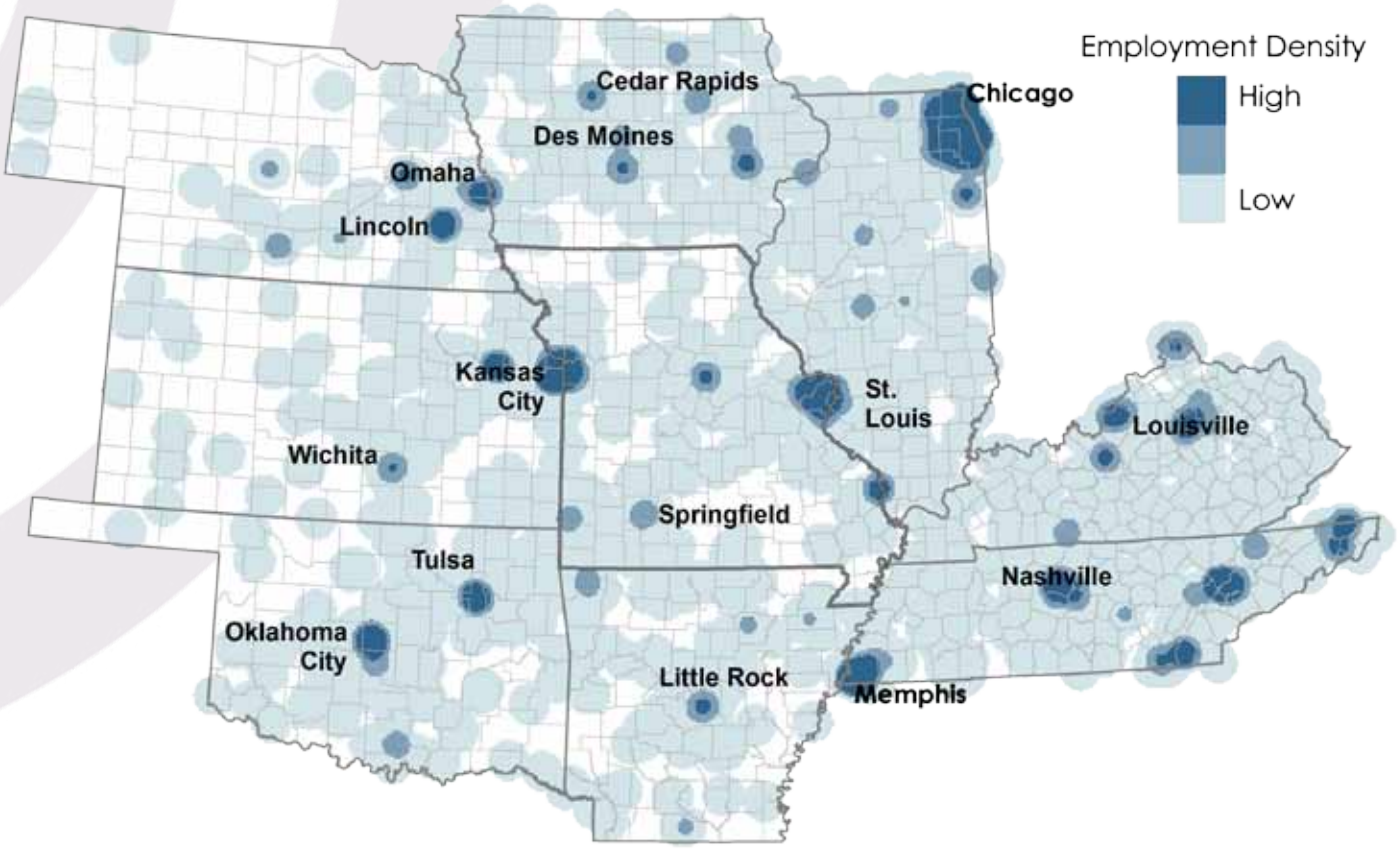


Midwest Employment Trends

Missouri ranks third behind Illinois and Tennessee in Biomedical sector employment within the Midwest with nearly 15% of the cluster's total non-farm employment in the nine-state area. Employment density is highest in the metro areas of St. Louis, Kansas City, Columbia, and Cape Girardeau. The regional map highlights the areas of heavy employment density for the Biomedical cluster.

Missouri public and private sector employment trends from 2006-2010 are down -9.3% for this cluster. Illinois, with over a third of the region's employment in this sector, showed modest job gains of 0.8%. Tennessee had the highest percentage gain from 2006-2010, with 25.7%. Five of the states experienced losses in this sector. The Midwest over-the-year trend held steady with an estimated +0.9% increase.

Regional Employment Density for Biomedical Sciences



Missouri Biomedical Exports

Missouri ranks 19th nationally in Biomedical exports. The Biomedical sector's export value makes up nearly 7% of the total Missouri commodity base and has shown moderate growth of 14% between 2006 and 2010, but does continue to trail national growth in this sector by 32 percentage points over the last five years. However this year is looking up for the state which is continuing its 14% growth while national Bio-Medical exports are down 1%.

Biomedical commodities are divided into two groups: Pharmaceuticals and Medicines, and Medical Equipment and Supplies. The state has a higher concentration of Pharmaceutical and Medicinal exports than the national average with an LQ of 1.53.

The state's biggest exporting industries in the Biomedical sector include vaccines for veterinary medicine, medicaments/medicines, and ophthalmic instruments and appliances. Compared to national averages, the state also has very high export concentrations, indicated by the 2010 Location Quotient (LQ) number, in the areas of veterinary vaccines, opacifying preps for x-ray exams, and measuring devices for machines that balance mechanical parts. For example, Missouri exports over 44 times the national average in veterinary vaccines, ranking Missouri #1 in the nation.

While Missouri may have trailed the nation in the five year trend, several commodity sectors are above the national trend in over-the-year growth including antisera (blood containing antibodies), devices for measuring electricity, medicines containing alkaloids, and optical radiation instruments for physical or chemical analysis. The table below highlights the five year trends and the over-the-year trends in Biomedical Science commodities.

Industry	2010 MO EXPORTS	%2006-2010 MO	%2006-2010 US	Biomedical Sciences MO Export 2010 LQ	MO Biomedical Sciences 2010-2011 YTD Trend (% Diff from US)
TOTAL ALL INDUSTRIES	$12,925,559,774	1.1	24.6		
TOTAL PHARMACEUTICALS AND MEDICINES	$765,126,673	12.8	48.8	1.53	16.6
TOTAL MEDICAL EQUIPMENT AND SUPPLIES	$104,310,522	26.6	40.5	0.39	23.0
High Growth (5 yr trend) / High Concentration					
Vaccines For Veterinary Medicine	$271,682,813	496.5	107.8	44.45	7.2
Opacifying Preparations For X-Ray Examinations	$27,990,213	192.7	61.5	35.46	-14.8
Measuring/Checking Machines For Balancing Mechanical Parts	$27,604,484	33.0	27.4	20.37	5.9
Instruments And Apparatus For Measuring Electricity	$16,068,017	N/A	N/A	4.01	50.5
Medicaments, In Measured Doses, Containing Hormones	$12,208,370	3502.1	6.0	1.68	-30.6
Medicaments, In Measured Doses Containing, Alkaloids Or Derivatives	$11,824,919	17.0	-3.9	1.68	42.1
High Growth (5 yr trend) /Low Concentration					
Antisera And Other Blood Fractions	$49,475,444	224.3	90.9	0.58	107.3
Other Instruments For Physical Or Chemical Analysis	$8,666,048	92.2	28.2	0.44	-7.0
Parts And Accessories For Measuring Or Checking Instruments	$8,286,902	6.5	-25.8	0.99	-8.8
Human Blood; Animal Blood Prepared For Therapeutic Uses	$6,062,109	112.5	53.0	0.76	6.1
Lower Growth (5 yr trend) / High Concentration					
Ophthalmic Instruments And Appliances	$53,598,598	69.4	74.3	7.38	27.9
Instruments For Physical Or Chemical Analysis Using Optical Radiations	$47,650,504	51.8	73.3	2.15	34.2
Therapeutic Respiration Apparatus	$15,844,099	37.4	57.0	1.62	-8.3
Lower Growth (5 yr trend) / Low Concentration					
Medicaments (Excl. Vaccines, Coated Bandages And Pharmaceuticals)	$69,420,601	-73.7	50.6	0.36	-26.5
Electro-Diagnostic Apparatus	$21,588,348	-15.8	27.3	0.59	-2.5
Instruments For Medical, Surgical Or Veterinary Sciences	$15,802,978	-43.6	50.7	0.16	27.4

Workforce

Missouri's Biomedical occupations are primarily made up of Production Line positions (23%), Office Administration and Support Services (13%), Healthcare Practitioners and Technical Services (9%), Science and Research Services (9%) and IT Services (8%). The Biomedical sector is projected to increase employment by 16.5% over the next 10 years, compared to 3.6% for all occupations. Of the Biomedical occupations projecting growth over the next decade, Production line workers are expected to make up over 14% of the growth with IT Services and Healthcare Practitioners and Technical Services both constituting 13% each. Wages for the prospective growth occupations are estimated to average nearly $54,000.

Occupations experiencing the most growth over this time period include Computer Specialists, Medical and Clinical Laboratory Technologists, and Dental Laboratory Technicians. Team Assemblers, Computer Specialists, and Dental Laboratory Technicians are expected to hold the largest number of jobs over the next decade.

Top Occupations by Projected Growth 2008-2018

Biomedical Occupations	Typical Education	Average Wage
Scientists and Lab Technicians		
Medical and Clinical Laboratory Technologists	Bachelor's degree	$51,525
Medical and Clinical Laboratory Technicians	Associate degree	$32,580
Dental Laboratory Technicians	Long-term on-the-job training	$36,804
Biochemists and Biophysicists	Doctoral degree	$63,276
Medical Scientists, Except Epidemiologists	Doctoral degree	$67,086
Biological Technicians	Bachelor's degree	$36,503
IT Services		
Computer Specialists, All Other	Associate degree	$74,506
Network Systems and Data Communications Analysts	Bachelor's degree	$74,788
Production		
Team Assemblers	Moderate-term on-the-job training	$26,474
Industrial Machinery Mechanics	Long-term on-the-job training	$43,547
Maintenance and Repair Workers, General	Moderate-term on-the-job training	$34,274
Mixing and Blending Machine workers	Moderate-term on-the-job training	$35,133
Management and Administrative Services		
Business Operations Specialists, All Other	Bachelor's degree	$60,872
Executive Secretaries and Administrative Assistants	Work Experience in a Related Occupation	$41,896
Accountants and Auditors	Bachelor's degree	$58,199

Analysis of education and experience levels typically required by all occupations in the Biomedical sector shows that 13.7% are considered lower skilled, 51.0% are middle skilled, and 35.3% are high skilled. Biomedical skill requirements are more heavily weighted towards middle to high skill occupations with 86.3% of the jobs in this sector requiring middle to high skills compared to 63.6% for all occupations in Missouri.

Sources:

U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages
U.S. Bureau of Labor Statistics, Occupational Employment Survey
U.S. National Institutes of Health
U.S. Patent and Trademark Office
U.S. Department of Agriculture, Census of Agriculture, 2007
MERIC, Long Term Occupational Projections 2008-2018
Missouri University of Science and Technology
National Center for Education Statistics; National Assessment of Education Progress
Market Street Consultants, Missouri Target Cluster Analysis, March 2011
Missouri Partnership
PriceWaterhouseCoopers and the National Venture Capital Association MoneyTree ™ Report
Reference USA Business Database
Danforth Plant Science Center
St. Louis Community College
WiserTrade Export Data
Deloitte, Oracle, and The Manufacturing Institute, "People and Profitability Study: A Time for Change." 2009.

Methodology:

Bioscience Industry Definitions from Market Street Consultants.

NAICS	Biosciences
	Plant and Animal Sciences
1111	Oilseed and Grain Farming
1122	Hog and Pig Farming
1152	Support Activities for Animal Production
3111	Animal Food Mfg
3112	Grain and Oilseed Milling
3251	Basic Chemical Mfg
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Mfg
3254	Pharmaceutical and Medicine Mfg
4245	Farm Product Raw Material Merchant Wholesalers
5417	Scientific Research and Development Services
5419	Other Professional, Scientific, and Technical Services
	Biomedical Sciences
3254	Pharmaceutical and Medicine Mfg
3391	Medical Equipment and Supplies Mfg
5417	Scientific Research and Development Services
6215	Medical and Diagnostic Laboratories

Location Quotients

Location quotient (LQ) is a statistical measure of an industry concentration. The quotient indicates the geographical concentration of an industry in a region as a function of the expected concentration based on national average. Location Quotient was calculated using the BLS Regional Data Analysis Tool (RDAT).The LQ formula is:
(Region Industry Emp. / Region Total Emp.) / (U.S. Industry Emp. / U.S. Total Emp.)

LQ>1 indicates an industry concentration.
LQ=1 indicates expected concentration based on U.S. average.
LQ<1 indicates no industry concentration.

About MERIC

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